REMARKS

Applicant would initially like to thank the Examiner for his recent helpful and courteous telephonic discussions with applicant's undersigned representative, and for his prompt response to the Request for Reconsideration filed subsequent to the final Office Action.

Upon entry of the present Preliminary Amendment-A the claims in the application are claims 1-12 and 14-22, of which claims 1, 14 and 18 are independent. The Commissioner is hereby authorized to charge $18.00 to Deposit Account No. 500744 in the name of Carrier, Blackman & Associates, P.C., in payment of the fee for presentation of a 21st claim. A duplicate copy of this sheet is attached.

In the above amendments, claims 1 is amended to incorporate the limitation of claim 13 (now cancelled), while claims 14 and 18 are rewritten in independent form including the limitations of claim 1 from which they formerly depended, and new claims 20-22 define further aspects of the method of claim 14.

Applicant respectfully submits that all of the amendments presented are fully supported by the original disclosure, including the discussion at pages 5-7 of the specification.

Restriction Requirement

As set forth at item 2 of the Office Action, the Examiner has imposed a restriction requirement relative to claims 13-19 added in Amendment-B and has withdrawn new claims 13-19 from consideration as allegedly being directed to a constructively non-elected, patentably distinct invention (or species) from the invention set forth in claims 1-12. It is the Examiner's position that the invention, as previously claimed and presented in the application (claims 1-12), is directed to a method generally involving a raw material such as SOG having a low dielectric

constant in which the oxygen concentration is maintained at a low level during formation and processing of a coating film, but not to specific SOG materials prepared from specific reagents, while the new claims 13-19 are directed to several other species of SOG prepared from specific materials or reagents, such as alkoxides.

Applicant's Response

Upon careful consideration, applicant respectfully traverses the restriction requirement because claims 13-19 (now claims 14-19) are directed to the *same invention* as set forth in independent claim 1, albeit in more narrowly defined terms (but that is the nature of dependent claims). Claims 14-19 all depend from independent claim 1, whether directly or indirectly through another claim, and present more specific definitions of the "raw material of a low dielectric constant" as defined in claim 1.

In this regard, applicant respectfully traverses the Examiner's allegation regarding the object/focus of the invention because such allegation is contradicted by the full disclosure of the specification. While the general focus of the application and the original claims relates to the processing conditions of preparing the coating film under low oxygen concentrations, the specification also presents specific examples involving specific raw materials and the preparation of same, such that the features of claims 13-19 are indisputably a part of the *same invention* as set forth in claim 1.

Further, in the amendments presented herewith independent claim 1 is modified to include the limitation of claim 13 (now cancelled) further reflecting that the focus of the invention, while new claims 20-22 set forth important aspects of the invention pertaining to the nature of the SOG raw material , discussed at length on pages 5-7 of the original specification.

Additionally, applicant notes that the Examiner comments regarding the restriction alternately indicate that the claims 13-19 are directed to a patentably distinct invention and a patentably distinct specie from that of claims 1-12. In this regard, applicant also respectfully submits that claims 13-19 are not directed to a different specie of invention than claims 1-12. Again, claims 13-19 merely further define the SOG raw material set forth in independent claim 1.

Based on the foregoing, it is respectfully requested that the restriction requirement be reconsidered and withdrawn.

Art-Based Rejections Under 35 USC §§ 102(e) and 103(a)

The Examiner continues to reject of claims 1, 2 and 9 under 35 USC '102(e) as being anticipated by You et al. (US Patent Application Publication 2001/0029111), and to reject claims 3-8 and 10-12 under 35 USC '103(a) as being unpatentable over You et al. as applied above and further in view of Sloan (US Patent 5,431,700) and/or applicant's admitted prior art of the dual damascene method shown in Figs. 1(a) - 1(h) (AAPA) or the treatise discussion of Wolf et al. relating to silicon processing through damascene methods, presented at items 7-9 of the Office Action. The Examiner's positions regarding the rejections remains as set forth in the prior Office Action of 18 April 2002. Additionally, at item 10 of the present Office Action, the Examiner presents a Response To Arguments in which the Examiner asserts that the discussion in You's paragraph [0153], "The **combination** of step-ramp curing **and** an inert gas environment for **heating**, high temperature cure, and **cooling** steps can provide thin films with high mechanical strength and minimized oxidation, therefore leading to thin films having lower dielectric constants, such as below about 3.0 (emphasis added by the Examiner)", contradicts applicant's argument that You only uses an inert environment for the curing step and therefore does not use the inert atmosphere during the heating step to 200°C; and that that You's paragraphs [0143] - [0152] are directed to "... such heating steps which occur clearly at temperatures below 200°C."

Applicant's Response

Upon careful consideration and in light of the above amendment to claim 1, applicant respectfully traverses such rejection, and submits that claims 1-12 are clearly patentably distinct

over the You reference and the other applied art, based on those reasons discussed in Amendment-B (i.e., You's disclosed method(s) of forming low dielectric constant coating films does not include the specific temperature-based limitations set forth in present claim 1, and such limitations are not made obvious by any other evidence of record including Sloan, AAPA and Wolf), and the following.

Initially, applicant above notes the above amendment to claim 1 defining that the raw material of a low dielectric constant is an organic SOG having a carbon content of 5-25 atomic weight %. This feature is not disclosed or suggest by You.

Further, applicant again respectfully submits that You's disclosure, when properly considered *as a whole*, does not anticipate or make obvious the specific temperature-based limitations of claim 1 which are critical to the particularly favorable result achieved by the invention. While You's paragraph [0153], as quoted by the Examiner, briefly and generally refers to heating and cooling steps being conducted in an inert gas environment, the full disclosure of the You patent, including paragraphs [0056], [0143] - [0153] and the drawings, clearly show that You's method does not meet or suggest the conditions set forth in claim 1 that the oxygen content in the atmosphere surrounding the plate-like material be less than or equal to 1% before the surface temperature of the material rises to 200°C, and again until the surface temperature lowers to 200°C after having been heated to a temperature above 400°C.

For example, the heating steps discussed at You's paragraphs [0142] - [0153] do not occur at temperatures below 200°C, contrary to the Examiner's allegation. The lowest temperature indicated in any of these paragraphs is 250°C. Again, claim 1 requires before the surface temperature of the material rises to 200°C, the oxygen content in the atmosphere surrounding the plate-like material be less than or equal to 1%.

Moreover, according to You's complete disclosure, an inert gas environment is achieved for his various processing steps only in conjunction with processing chambers such as the deposition chambers 100a, 100b shown in his Figs. 1a, 1b (via bias gas inflow sources 124, 126),

curing ovens, etc., whereas You also specifically indicates that the film is removed from the processing chambers after the various processing steps, including all of the specific discussion and examples of You's curing process. See, for example, You's paragraphs [0149] and [0151], where he explains that after a film has been cured (the curing operation including steps for cooling a film to a point where the curing is complete) it is "... removed from the curing oven and allowed to cool to room temperature." Applicant respectfully submits that the fair understanding of You's disclosure when considered as a whole is that an inert gas environment is maintained within the various processing chambers, including curing ovens where temperatures are raised and lowered in steps, whereas no such inert gas environment is maintained outside of the processing chambers, including when the films are removed from the curing ovens and allowed to cool to room temperature. When viewed in context and consistent with his full disclosure, the heating and cooling steps mentioned in You's general discussion of paragraph [0153] are simply the heating and cooling steps involved in the curing processes.

Again, the specific disclosure of paragraph [0151] indicates that a high temperature curing oven is preheated to 300°C before the wafer is placed therein, and that once the high temperature cure of the film is ramped down (cooled) to 300°C the cured wafer *is removed from the curing oven* and allowed to cool to room temperature. This indicates that the final cooling of the wafer from 300°C to room temperature is not performed in the inert gas environment, contrary to the requirements of claim 1 that the oxygen content in the atmosphere surrounding the plate-like material be less than or equal to 1% until the surface temperature lowers to 200°C after having been heated to a temperature above 400°C.

Applicant respectfully submits that the above distinctions are very significant because the present invention achieves significant advantage over conventional processes not only in terms of low dielectric constants of the cured coating film, but also a significantly smaller degree of film thickness reduction (shrinkage). In this regard, applicant encloses herewith a chart and an associated graph showing Film Shrinkage Data of Low O_2 Bake Plate, where the results of film thickness reduction (shrinkage) in the cases where the oxygen concentration was set at 20.80%, 10.00%, 1.00%, 1000ppm and 100ppm, respectively, while the treatment time and temperature was kept the same. As indicated by the data, the difference between the initial film thickness and

the baked film thickness can be reduced to an acceptabl level in the case where the oxygen concentration was 1.00% or less, which is a primary aspect of claim 1. On the other hand, the Lu reference does not meet the limitations of claim 1 as discussed above, and does not otherwise address or appreciate the significant advantage of less film shrinkage as achieved by the present invention.

Based on the foregoing, applicant respectfully submits that the rejections of claims 1-12 under 35 USC '102(e) and 103(a) are overcome, and accordingly it is respectfully requested that such rejections be reconsidered and withdrawn.

Conclusion

In conclusion, applicant: respectfully request reconsideration of the restriction requirement; has overcome the Examiner's rejections set forth in the final Office Action, and moreover, applicant respectfully submits that the application is now in condition for allowance, and a notice to that effect is earnestly solicited.

Favorable reconsideration is respectfully requested.

A Petition For Three-Month Extension has been previously filed relative to the final Office Action, while an RCE is filed concurrently herewith.

Respectfully submitted,

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CERTIFICATE OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via facsimile to the US Patent & Trademark Office, Art Unit 2813 September 24, 2003.

Marked-Up Copy of Amended Claims 1, 14 and 18

1. (Currently amended) A method for forming a coating film, comprising the steps of:

applying a raw material of a low dielectric constant onto a surface of a plate-like material to be treated;

reducing oxygen concentration in the atmosphere surrounding the plate-like material to be less than or equal to 1% before a surface temperature of said plate-like material to be treated rises to 200°C; thereafter

heating said plate-like material to be treated to a temperature greater than or equal to 400°C; and then

maintaining the oxygen content in the atmosphere to be less than or equal to 1% until the surface temperature of said plate-like material to be treated lowers to 200°C;

said raw material of a low dielectric constant is organic SOG having a carbon content of 5-25 atomic weight %.

14. (Currently amended) A method for forming a coating film [as defined in claim 1, wherein], comprising the steps of:

applying a raw material of a low dielectric constant onto a surface of a plate-like material to be treated;

reducing oxygen concentration in the atmosphere surrounding the plate-like material to be less than or equal to 1% before a surface temperature of said plate-like material to be treated rises to 200°C; thereafter

heating said plate-like material to be treated to a temperature greater than or equal to 400°C;

and then

maintaining the oxygen content in the atmosphere to be less than or equal to 1% until the surface temperature of said plate-like material to be treated lowers to 200°C;

said raw material is an organic SOG obtained by hydrolyzing and condensing at least one alkoxysilane compound expressed by the following equation (I) into an organic solvent under an acid catalyst,

$RnSi(OR^1)_{4-n}$ .....(I)

where R is an alkyl group or an aryl group having a carbon number of 1-4, , R^1 is an alkyl group having a carbon number of 1-4, and n is an integer of 0-2.

18. (Currently amended) A method for forming a coating film [as defined in claim 1, wherein], comprising the steps of:

applying a raw material of a low dielectric constant onto a surface of a plate-like material to be treated;

reducing oxygen concentration in the atmosphere surrounding the plate-like material to be less than or equal to 1% before a surface temperature of said plate-like material to be treated rises to 200°C; thereafter

heating said plate-like material to be treated to a temperature greater than or equal to 400°C; and then

maintaining the oxygen content in the atmosphere to be less than or equal to 1% until the surface temperature of said plate-like material to be treated lowers to 200°C;

said raw material is an organic SOG obtained by hydrolyzing and condensing at least one

alkoxysilane compound expressed by the following equation [(I)] (II) into an organic solvent under an acid catalyst,

$RnSi(OR^1)_3$ .....(II)

where R is an alkyl group or an aryl group having a carbon number of 1-4, and R^1 is an alkyl group having a carbon number of 1-4.